

Program Outcomes and Course Outcomes

Department of Chemistry

Program Outcomes

PO 1: Students will be capable of demonstrating comprehensive knowledge and understanding both theoretical and practical in all disciplines of Chemistry.

PO 2: Students can solve their subjective problems very methodically, independently and finally draw a logical conclusion.

PO3: Students can develop critical thinking and to design, carry out, record and analyze the results of chemical reactions.

PO 4: Students will able to get good laboratory practice with proper safety.

PO 5: Students can find out the green route for chemical reaction for sustainable development.

PO 6: Students will be capable of applying modern technologies, handling advanced instruments and Chemistry related soft-wares for chemical analysis, characterization of materials and in separation technology.

PO 7: Create an awareness of the impact of chemistry on the environment, society, and development outside the scientific community.

PO 8: To prepare the students for a successful career in industry and to motivate them for higher education and take up research as a career.

PO 9: To develop an opportunity to work in interdisciplinary groups.

Course Outcomes

Semester	Course code	Course Outcomes
	Inorganic Chemistry-I CC 1-1-TH & Inorganic Chemistry Lab CC 1-1-P	CO1: Understand the extra nuclear structure of atom, Pauli's Exclusion Principle, Hund's rules, Aufbau principle. CO2: Gives a concept about various types of acid-base, their definitions and also gives a clear idea about HSAB principle pH, buffer, indicator and Acid base indicator curves. CO3: Understand the basic concept of redox reaction, Nernst Equation, Redox potential, redox indicator, Redox titration CO4: Study the estimation of ions or salts by acid-base titration method and oxidation-reduction titration method.
	Organic Chemistry-1A CC 1-1-TH & Organic Chemistry: LAB CC 1-1-P	CO1: Gives basic concepts of shapes & hybridisation, of molecules, resonance, inductive effect, field effect, mesomeric effect, resonance energy, electromeric effect, steric effect. CO2: Understand about MO theory, bonding and antibonding interactions, concept of HOMO, LUMO and aromaticity CO3: Students will get the clear idea about the different reaction mechanism in organic chemistry.

SEM-1		CO4: Helps to develop the hand-on skill to determine the nature of the organic compounds on the basis of solubility.
	Physical Chemistry-1 CC 1-2-TH & Physical Chemistry: LAB CC 1-2-P	CO1: Gives the fundamental concept of kinetic theory and gaseous state: General treatment of Maxwell's distribution of speed and energy, concept of real gases and Virial equation. CO2: Understand transport processes such as Diffusion and Viscosity. CO3: Know basic concepts of chemical kinetics, different reactions order, temperature dependence of rate constants and homogeneous catalysis. CO4: Experimentally determine viscosity of unknown liquid. solubility of sparingly soluble salt in water and in presence of electrolyte, kinetics of various chemical reactions.
	Organic Chemistry-1B CC 1-2-TH & Organic Chemistry: LAB CC 1-2-P	CO1: Students will learn three-dimensional structure of organic molecule which is very much essential to visualize molecules. CO2: Get an idea about the structure and nature of intermediates like carbocations, carbanions, radicals and carbenes. CO3: Helps students to develop laboratory training to use melting point and boiling apparatus.
SEM-2	Organic Chemistry-2 CC 2-3-TH & Organic Chemistry LAB CC 2-3-P	CO1: Understand stereochemistry of chiral compounds arises due to presence of stereo-axis; concept of prostereoisomerism and concept of conformations of stereo isomers. CO2: Learn reaction kinetics, reaction thermodynamics and tautomerism of organic compounds. CO3: Understand the types, reaction mechanism and examples of elimination, free-radical and nucleophilic substitution reactions. CO4: Study experimentally how to synthesize, calculate the yield and determine the melting point of pure organic compounds in the laboratory.
	Inorganic Chemistry-2 CC 2-4-TH & Inorganic Chemistry LAB CC 2-4-P	CO1: Students will learn ionic bond and covalent bond, laws, rules and equations for formation of chemical bonds, solubility, hybridization and dipole moment of molecules. CO2: Understand about MOT (Molecular orbital theory), LCAO (Linear combination of atomic orbitals), Metallic bond and Weak Chemical Forces etc. CO3: Know about the concept of radioactivity and radioactive compounds, nuclear reactions, artificial radioactivity, radio carbon dating, hazards of radiation and safety measures. CO4: Study experimentally how to estimate the percentage of chlorine in bleaching powder; vitamin C; arsenic and antimony in a sample by iodimetric titration method. Student will learn how to estimate Cu in brass, Cr and Mn in steel and Fe in cement.

Semester	Course code	Course Outcomes
SEM-3	Physical Chemistry-2 CC 3-5-TH & Physical Chemistry LAB CC 3-5-P	<p>CO1: Concept of chemical Thermodynamics including the laws and the applications of thermodynamics. To get knowledge about new thermodynamic functions such as entropy, Gibbs free energy, Helmholtz free energy etc.</p> <p>CO2: Understand chemical equilibrium and electrochemistry.</p> <p>CO3: Students will learn experimentally the potentiometric and conductometric titrations, determine the K_a of weak acid and heat of neutralization of a strong acid by a strong base.</p>
	Inorganic Chemistry-3 CC 3-6-TH & Inorganic Chemistry LAB CC 3-6-P	<p>CO1: Students will learn about modern periodic table, physical and chemical properties of the elements along a group or period.</p> <p>CO2: Understand the chemistry of s and p block elements including noble gases and their compounds in detail.</p> <p>CO3: Get knowledge of some inorganic and organic polymers with synthesis, structural aspects and applications.</p> <p>CO4: Understand the meaning of various terms involved in coordination chemistry, Werner's theory for complex formation, structural and stereoisomerism of coordination complexes.</p> <p>CO5: Study practically the complexometric and gravimetric estimation of different ions, chromatographic separation of (i) Ni (II) and Cu (II) ions, (ii) Fe (III) and Al (III) ions.</p>
	Organic Chemistry-3 CC 3-7-TH & Organic Chemistry LAB CC 3-7-P	<p>CO1: Understand the chemistry of alkenes and alkynes and the name reactions involved and idea about Electrophilic aromatic substitution, and Nucleophilic aromatic substitution.</p> <p>CO2: Know the chemistry of carbonyl compounds in detail and depth including reactions involving exploitation of acidity of α-H of C=O</p> <p>CO3: Students will learn chemistry of Organometallics, including Grignard reagents, organolithiums etc.</p> <p>CO4: Study experimentally the qualitative detection of solid and liquid organic compounds. and quantitative analysis of some organic compounds used in daily life.</p>

Semester	Course code	Course Outcomes
SEM-3	SEC	<p>SEC-1: Mathematics and statistics for chemists</p> <p>CO1: Understand mathematical functions, differential equations, probability, vectors, matrices and determinants.</p> <p>CO2: Study about qualitative and quantitative aspects of analysis and helps to understand how to present a data after analysis.</p> <p>SEC-2: Analytical clinical biochemistry</p> <p>CO1: Understand about the preparation, structures, reactions and biological importance of carbohydrates, proteins, enzymes, lipids and lipoproteins.</p> <p>CO2: Students will learn the biochemistry of different diseases through</p>

		<p>a diagnostic approach by blood and urine analysis.</p> <p>CO3: Know how to isolate proteins and how to perform the qualitative estimation of carbohydrate, proteins and lipids.</p> <p>CO4: Study experimentally the quantitative estimation of carbohydrate, cholesterol, nucleic acids, determination of the iodine number of oil and saponification number of oil.</p>
SEM-4	<p>Organic Chemistry-4 CC 4-8-TH & Organic Chemistry LAB CC 4-8-P</p>	<p>CO1: Understand the Chemistry of nitrogen compounds involving preparation and reactions of amines, nitro compounds, alkyl nitriles and isonitriles, diazonium salts etc.</p> <p>CO2: Get knowledge about rearrangement reactions involving migration to electron deficient nitrogen atoms and allied systems</p> <p>CO3: Understand retrosynthetic analysis: disconnections; synthons, strategy of ring synthesis, asymmetric synthesis etc.</p> <p>CO4: Get an idea about analysis of different organic compounds using different spectroscopic methods.</p> <p>CO5: Study experimentally the qualitative analysis of single solid organic compounds</p>
	<p>Physical Chemistry-3 CC 4-9-TH & Physical Chemistry LAB CC 4-9-P</p>	<p>CO1: Know various applications of chemical thermodynamics such as colligative properties and phase equilibria.</p> <p>CO2: Concept of fundamentals of Quantum mechanics with special emphasis of the concept of operators, particle in a box.</p> <p>CO 3: Understand about the various types of solids, helps to know the Bravais lattice and laws of crystallography, crystal planes and specific heat of solid</p> <p>CO4: Study the experimental techniques such as polarimetry, thermometry with phenol-water system and pH-metry.</p>
	<p>Inorganic Chemistry-4 CC 4-10-TH & Inorganic Chemistry LAB CC 4-10-P</p>	<p>CO1: Get an idea about the structures, stability, colour, magnetism and Orgel diagram of the co-ordination compounds on the basis of modern concepts of chemical bonding.</p> <p>CO-2: Helps to understand the chemical and physical properties of d and f Block elements and their compounds.</p> <p>CO-3: Understand the reaction kinetics and mechanisms of inorganic reactions.</p> <p>CO4: Study experimentally how to synthesize inorganic complexes and determine the λ_{max} values of inorganic complexes. To calculate the 10Dq value by spectrophotometric method.</p>
SEM-4	SEC-B	<p>SEC-3: Pharmaceuticals Chemistry</p> <p>CO1: Get an idea about the drug discovery, design and development of representative drugs of the following classes: Analgesics, Antipyretic, Anti-inflammatory, Anti-bacterial, Antifungal, Antiviral, Antibiotics, Anti-laprosy etc.</p> <p>CO2: Understand about aerobic and anaerobic fermentation.</p> <p>CO3: Study experimentally the preparation of aspirin and magnesium bisilicate (Antacid).</p> <p>SEC-4. Pesticide Chemistry</p> <p>CO1: Students will learn about the preparation, structures, properties, reactions, benefits and adverse effects of pesticide of the following classes: Organochlorines, Organophosphates, Carbamates, Quinones.</p>

		<p>CO2: Know how to calculate acidity/ alkalinity in a given sample of pesticide formulations as per BIS specifications.</p> <p>CO3: Study experimentally the preparation of organophosphates, phosphonates and thiophosphates.</p>
SEM-5	<p>Physical Chemistry-4 CC 5-11-TH & Physical Chemistry LAB CC 5-11-P</p>	<p>CO1: Develops the concept of the various quantum mechanical systems such as simple harmonic oscillator, Hydrogen atom and also understand the chemical bonding with theories such as LCAO and Born-Oppenheimer approximation, MO theory.</p> <p>CO2: Understand the necessary laws, rules, terms, expressions and derivations of statistical thermodynamics</p> <p>CO3: Students will learn laws, rules and equations for numerical analysis of Roots of Equation and Least-Squares Fitting.</p> <p>CO4: Students become familiar with the computer program, FORTRAN and by using this program they can evaluate numerical differentiation, numerical integrations etc.</p>
	<p>Organic Chemistry-5 CC 5-12-TH & Organic Chemistry LAB CC 5-12-P</p>	<p>CO1: Get an idea about the chemistry of polynuclear aromatic hydrocarbons and their derivatives, their preparation, conformation and reactivity of alicyclic compounds</p> <p>CO2: Understand the reaction, mechanism, stereochemistry, regioselectivity of pericyclic reactions</p> <p>CO3: Understand biomolecules like carbohydrates and amino acids, proteins, nucleic acids-their basic chemistry, preparation</p> <p>CO4: Study experimentally how to separate molecules by chromatographic methods</p> <p>CO5: Helps to analyse organic spectra to solve structural problems on organic compounds.</p>
	<p>DSE</p>	<p>DSE A-1. Molecular Modelling & Drug Design</p> <p>CO1: Helps to study about Molecular Modelling, Force Fields, Energy Minimization and Computer Simulation.</p> <p>CO2: Understand Molecular Dynamics & Monte Carlo Simulation, Structure Prediction and Drug Design.</p> <p>CO3: Students will learn to optimiz C – C bond lengths and compare the shapes in different organic molecules.</p> <p>CO4: Study how to compare the shapes of molecules, build and minimize organic compounds containing various functional groups, compute resonance energy, heat of hydration.</p> <p>DSE A-2: Applications of Computers in Chemistry</p> <p>CO1: Get an idea about the basics of computer programming (FORTRAN), creating and application of spreadsheet software (MS Excel)</p> <p>CO2: Helps to know about statistical data analysis.</p> <p>CO3: Understand how to prepare graphs by using spreadsheet and application of spreadsheet software (MS Excel) to solve various types of chemical problems.</p> <p>CO4: Know the calculation and plotting of precipitation titration Curve, pH metric and potentiometric titration curve with MS Excel, Michaelis-Menten kinetics for enzyme catalysis using linear and non - linear regression.</p>

SEM-5	DSE	<p>DSE B-1: Inorganic materials of industrial importance</p> <p>CO1: Discussion about the silicate industries, fertilizers, surface coatings on the materials and their application.</p> <p>CO2: Introduction of solid state electrolyte, battery, Fuel cells, Solar cell and Polymer cell.</p> <p>CO3: Different catalysis and their activity in industrial application and introduction about explosives.</p> <p>CO4: Study experimentally how to analyze the composition of cement, composition of percentage of metals in alloy, electroless metallic coatings on ceramic and plastic.</p> <p>CO5: Understand how to determine free acidity in ammonium sulphate fertilizer, estimation of Calcium in Calcium ammonium nitrate fertilizer and phosphoric acid in superphosphate fertilizer.</p> <p>DSE B-2: Novel Inorganic Solids</p> <p>CO 1. Understand about the synthetic modification of different industrially important Inorganic solids, synthesis of nano material, polymers etc.</p> <p>CO2: Know how to synthesize hydro-gel by co-precipitation method and silver and gold nanoparticles.</p> <p>CO3: Study how to estimate ions by cation exchange method and total difference of solids in a composite material.</p>
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Semester	Course code	Course Outcomes
SEM-6	Inorganic Chemistry-5 CC 6-13-TH & Inorganic Chemistry LAB CC 6-13-P	<p>CO1: Understand the theoretical principles in qualitative analysis of cations and anions in various groups.</p> <p>CO2: Students will learn about the essential and beneficial elements of our life and various types of dioxygen management protein and their activity.</p> <p>CO3: Get an idea about inorganic polymers with types ,structural aspects and their applications in detail.</p> <p>CO4: Gives the idea about the structure and chemistry of several organometallic complexes</p> <p>CO5: Study experimentally the qualitative detection of known and unknown radicals and insoluble materials in a mixture.</p>
	Physical Chemistry-5 CC 6-14-TH & Physical Chemistry LAB CC 6-14-P	<p>CO1: Get a vast knowledge of the principles, experimental techniques and broad chemical application of Rotational, Vibrational, Electronic and Raman spectroscopy.</p> <p>CO2: Understand about the basic principles and laws of Photochemistry and know about the theory of reaction rate.</p> <p>CO3: Learn in detail about surface energy and surface tension; classification of Adsorption isotherms and applications of Adsorption; classification, rules and properties of Colloids.</p> <p>CO4: Study the fundamental concepts, important equations, properties and applications of polarizability and dipole moment.</p> <p>CO5: Experiments involving colorimetry, spectrophotometry and experiments related to surface tension as well as determination of CMC of micelles.</p>

SEM-6	DSE	<p>DSE A-3: Green Chemistry and Chemistry of Natural Products CO1: Discuss about the green chemistry and green synthesis, the future trends of green chemistry for sustainability. CO2: Learn the synthesis, psychological properties, isolation medicinal importance and other synthetic use of terpenes and alkaloids CO3: Study experimentally how to perform green synthesis of a number of organic compounds in the laboratory.</p> <p>DSE A-4: Analytical methods in Chemistry</p> <p>CO 1. Get an idea about different analytical methods (Flame Atomic Absorption, Emission Spectrometry, Thermogravimetry) to identify and separate the products formed during different chemical transformations. CO2: Understand the fundamental laws of spectroscopy and selection rules. CO3: Know the methods of separation of stereoisomers by spectral, chemical and chromatographic data analysis (IC, GLC, GPC, TLC and HPLC). CO4: Study experimentally how to separate and identify a mixture of monosaccharides by chromatography method. CO5: Evaluate the pK_a values of an indicator, COD and BOD using spectrophotometry.</p> <p>DSE B-3: Polymer Chemistry</p> <p>CO1: Know about the history, functionality and importance of polymeric materials. CO2: Understand the kinetics of polymerization, crystallization and crystallinity of polymers. CO3: Learn the preparation, nature and structure of polymers, determination of molecular weight of polymers, and Tg. CO4: Know experimentally the synthesis of polymers. CO5: Study experimentally how to characterize and analyze a polymeric compound or material.</p> <p>DSE B-4: Dissertation</p> <p>CO1: Understand how to do research work and write a review article on a particular field/topic as assigned by the teacher. CO2: Develop an idea how to prepare project report and digital presentation</p>
	DSE	